

# MMBT2369LT1, MMBT2369ALT1

MMBT2369ALT1 is a Preferred Device

## Switching Transistors

### NPN Silicon

#### Features

- Pb-Free Packages are Available

#### MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	$V_{CEO}$	15	Vdc
Collector-Emitter Voltage	$V_{CES}$	40	Vdc
Collector-Base Voltage	$V_{CBO}$	40	Vdc
Emitter-Base Voltage	$V_{EBO}$	4.5	Vdc
Collector Current - Continuous	$I_C$	200	mAdc

#### THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Total Device Dissipation FR-5 Board (Note 1) $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	225 1.8	mW mW/ $^\circ\text{C}$
Thermal Resistance, Junction-to-Ambient	$R_{\theta JA}$	556	$^\circ\text{C}/\text{W}$
Total Device Dissipation Alumina Substrate, (Note 2) $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	300 2.4	mW mW/ $^\circ\text{C}$
Thermal Resistance, Junction-to-Ambient	$R_{\theta JA}$	417	$^\circ\text{C}/\text{W}$
Junction and Storage Temperature	$T_J, T_{stg}$	-55 to +150	$^\circ\text{C}$

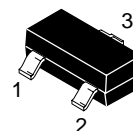
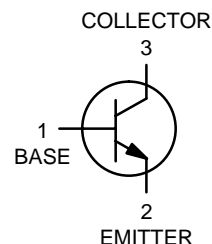
Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

- FR-5 =  $1.0 \times 0.75 \times 0.062$  in.
- Alumina =  $0.4 \times 0.3 \times 0.024$  in. 99.5% alumina.



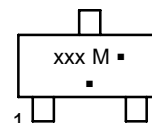
ON Semiconductor®

<http://onsemi.com>



SOT-23  
CASE 318  
STYLE 6

#### MARKING DIAGRAMS



xxx = M1J or 1JA  
M = Date Code\*  
▪ = Pb-Free Package

(Note: Microdot may be in either location)

\*Date Code orientation and/or overbar may vary depending upon manufacturing location.

#### ORDERING INFORMATION

Device	Package	Shipping
MMBT2369LT1	SOT-23	3000/Tape & Reel
MMBT2369LT1G	SOT-23 (Pb-Free)	3000/Tape & Reel
MMBT2369ALT1	SOT-23	3000/Tape & Reel
MMBT2369ALT1G	SOT-23 (Pb-Free)	3000/Tape & Reel

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

Preferred devices are recommended choices for future use and best overall value.

# MMBT2369LT1, MMBT2369ALT1

## ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
<b>OFF CHARACTERISTICS</b>					
Collector–Emitter Breakdown Voltage (Note 3) (I <sub>C</sub> = 10 mAdc, I <sub>B</sub> = 0)	V <sub>(BR)CEO</sub>	15	–	–	Vdc
Collector–Emitter Breakdown Voltage (I <sub>C</sub> = 10 μAdc, V <sub>BE</sub> = 0)	V <sub>(BR)CES</sub>	40	–	–	Vdc
Collector–Base Breakdown Voltage (I <sub>C</sub> = 10 μAdc, I <sub>E</sub> = 0)	V <sub>(BR)CBO</sub>	40	–	–	Vdc
Emitter–Base Breakdown Voltage (I <sub>E</sub> = 10 μAdc, I <sub>C</sub> = 0)	V <sub>(BR)EBO</sub>	4.5	–	–	Vdc
Collector Cutoff Current (V <sub>CB</sub> = 20 Vdc, I <sub>E</sub> = 0) (V <sub>CB</sub> = 20 Vdc, I <sub>E</sub> = 0, T <sub>A</sub> = 150°C)	I <sub>CBO</sub>	– –	– –	0.4 30	μAdc
Collector Cutoff Current (V <sub>CE</sub> = 20 Vdc, V <sub>BE</sub> = 0)	I <sub>CES</sub>	–	–	0.4	μAdc

## ON CHARACTERISTICS

DC Current Gain (Note 3) (I <sub>C</sub> = 10 mAdc, V <sub>CE</sub> = 1.0 Vdc) (I <sub>C</sub> = 10 mAdc, V <sub>CE</sub> = 1.0 Vdc) (I <sub>C</sub> = 10 mAdc, V <sub>CE</sub> = 0.35 Vdc) (I <sub>C</sub> = 10 mAdc, V <sub>CE</sub> = 0.35 Vdc, T <sub>A</sub> = –55°C) (I <sub>C</sub> = 30 mAdc, V <sub>CE</sub> = 0.4 Vdc) (I <sub>C</sub> = 100 mAdc, V <sub>CE</sub> = 2.0 Vdc) (I <sub>C</sub> = 100 mAdc, V <sub>CE</sub> = 1.0 Vdc)	MMBT2369 MMBT2369A MMBT2369A MMBT2369A MMBT2369A MMBT2369 MMBT2369A	h <sub>FE</sub>	40 – 40 20 30 20 20	– – – – – – –	120 120 – – – – –	–
Collector–Emitter Saturation Voltage (Note 3) (I <sub>C</sub> = 10 mAdc, I <sub>B</sub> = 1.0 mAdc) (I <sub>C</sub> = 10 mAdc, I <sub>B</sub> = 1.0 mAdc) (I <sub>C</sub> = 10 mAdc, I <sub>B</sub> = 1.0 mAdc, T <sub>A</sub> = +125°C) (I <sub>C</sub> = 30 mAdc, I <sub>B</sub> = 3.0 mAdc) (I <sub>C</sub> = 100 mAdc, I <sub>B</sub> = 10 mAdc)	MMBT2369 MMBT2369A MMBT2369A MMBT2369A MMBT2369A	V <sub>CE(sat)</sub>	– – – – –	– – – – –	0.25 0.20 0.30 0.25 0.50	Vdc
Base–Emitter Saturation Voltage (Note 3) (I <sub>C</sub> = 10 mAdc, I <sub>B</sub> = 1.0 mAdc) (I <sub>C</sub> = 10 mAdc, I <sub>B</sub> = 1.0 mAdc, T <sub>A</sub> = –55°C) (I <sub>C</sub> = 30 mAdc, I <sub>B</sub> = 3.0 mAdc) (I <sub>C</sub> = 100 mAdc, I <sub>B</sub> = 10 mAdc)	MMBT2369A MMBT2369A MMBT2369A MMBT2369A	V <sub>BE(sat)</sub>	0.7 – – –	– – – –	0.85 1.02 1.15 1.60	Vdc

## SMALL-SIGNAL CHARACTERISTICS

Output Capacitance (V <sub>CB</sub> = 5.0 Vdc, I <sub>E</sub> = 0, f = 1.0 MHz)	C <sub>obo</sub>	–	–	4.0	pF
Small Signal Current Gain (I <sub>C</sub> = 10 mAdc, V <sub>CE</sub> = 10 Vdc, f = 100 MHz)	h <sub>fe</sub>	5.0	–	–	–

## SWITCHING CHARACTERISTICS

Storage Time (I <sub>B1</sub> = I <sub>B2</sub> = I <sub>C</sub> = 10 mAdc)	t <sub>s</sub>	–	5.0	13	ns
Turn–On Time (V <sub>CC</sub> = 3.0 Vdc, I <sub>C</sub> = 10 mAdc, I <sub>B1</sub> = 3.0 mAdc)	t <sub>on</sub>	–	8.0	12	ns
Turn–Off Time (V <sub>CC</sub> = 3.0 Vdc, I <sub>C</sub> = 10 mAdc, I <sub>B1</sub> = 3.0 mAdc, I <sub>B2</sub> = 1.5 mAdc)	t <sub>off</sub>	–	10	18	ns

3. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2.0%.

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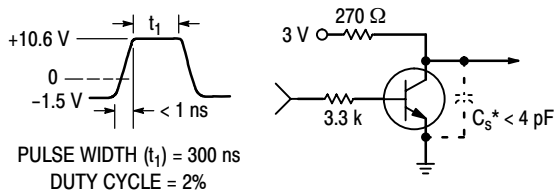


Figure 1.  $t_{on}$  Circuit – 10 mA

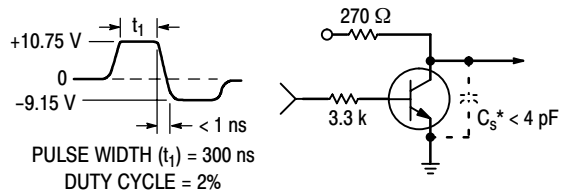


Figure 2.  $t_{off}$  Circuit – 10 mA

\*Total shunt capacitance of test jig and connectors.

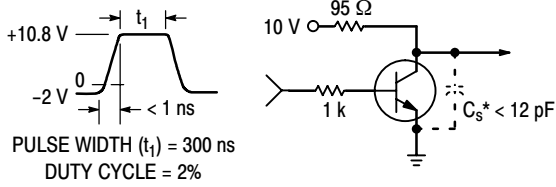


Figure 3.  $t_{on}$  Circuit – 100 mA

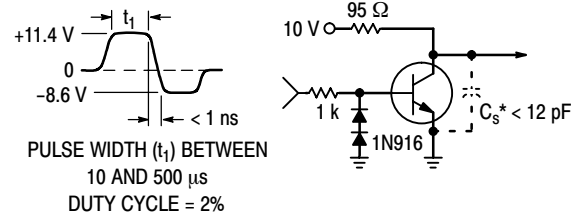
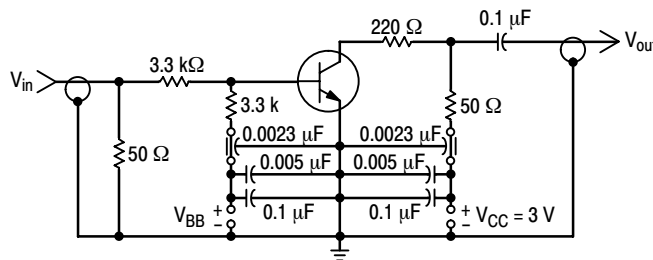
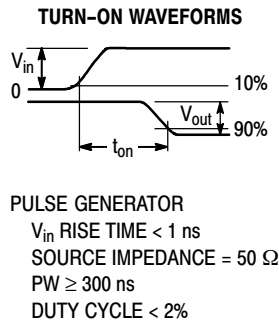


Figure 4.  $t_{off}$  Circuit – 100 mA

\*Total shunt capacitance of test jig and connectors.



TO OSCILLOSCOPE  
INPUT IMPEDANCE = 50  $\Omega$   
RISE TIME = 1 ns

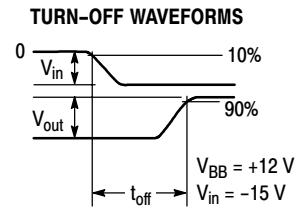


Figure 5. Turn-On and Turn-Off Time Test Circuit

# MMBT2369LT1, MMBT2369ALT1

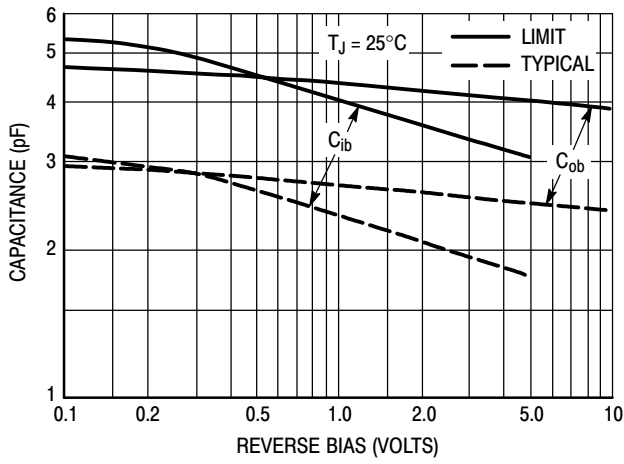


Figure 6. Junction Capacitance Variations

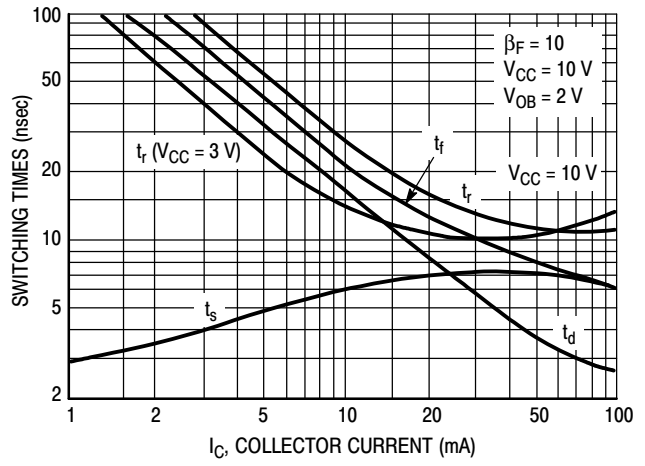


Figure 7. Typical Switching Times

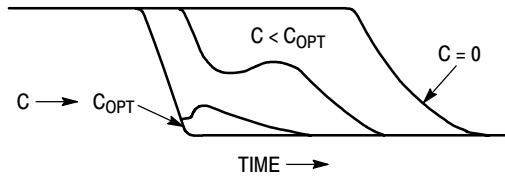


Figure 8. Turn-Off Waveform

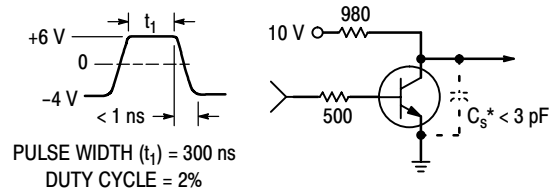


Figure 9. Storage Time Equivalent Test Circuit

# MMBT2369LT1, MMBT2369ALT1

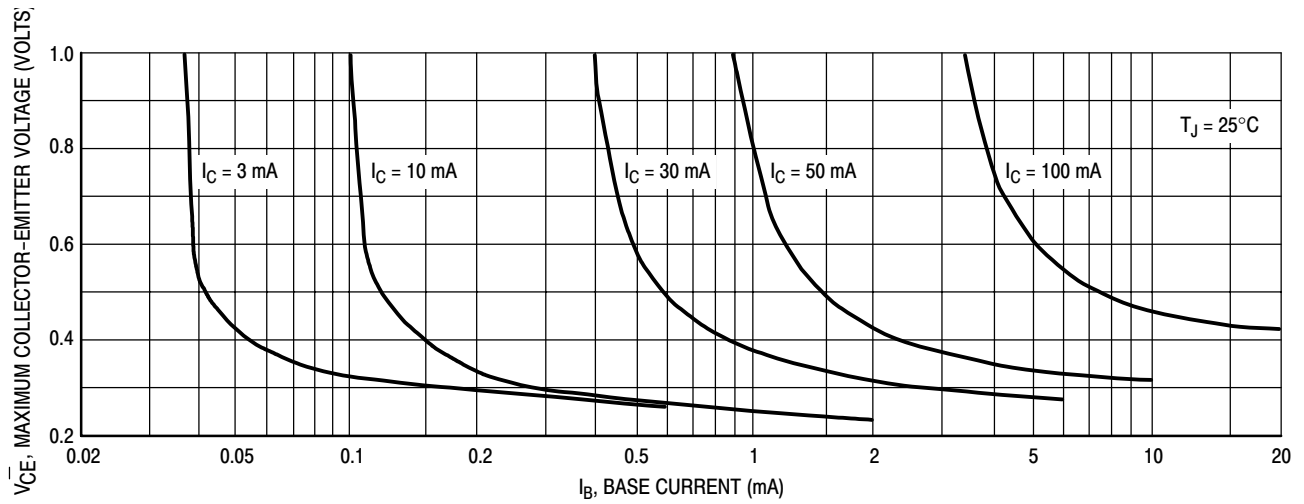


Figure 10. Maximum Collector Saturation Voltage Characteristics

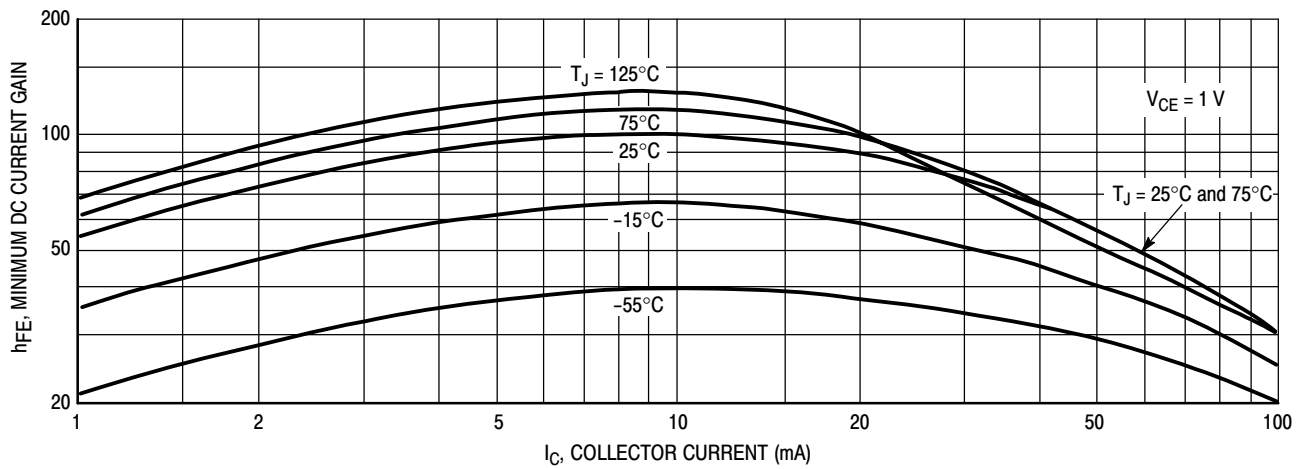


Figure 11. Minimum Current Gain Characteristics

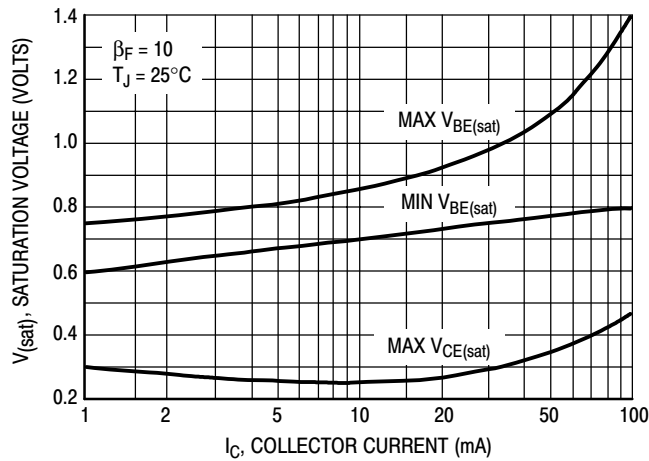
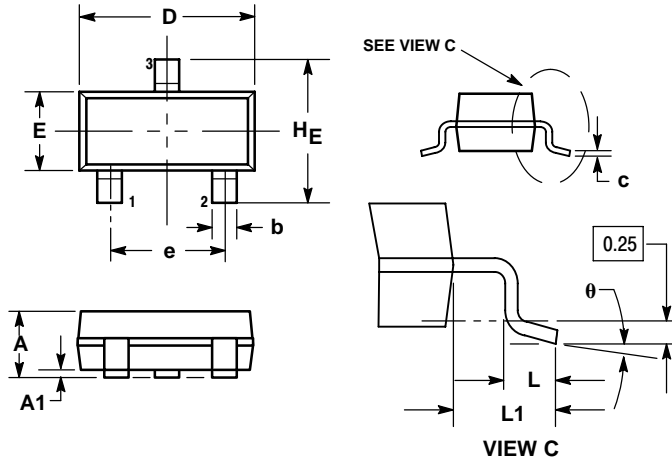


Figure 12. Saturation Voltage Limits

# MMBT2369LT1, MMBT2369ALT1

## PACKAGE DIMENSIONS

SOT-23 (TO-236)  
CASE 318-08  
ISSUE AN



NOTES:

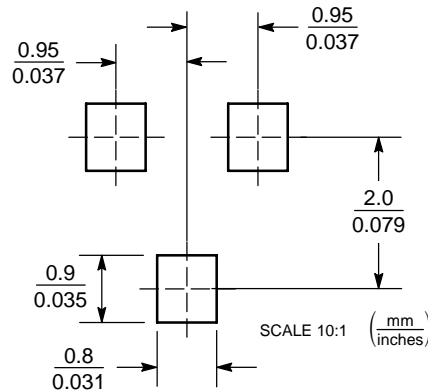
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. 318-01 THRU -07 AND -09 OBSOLETE, NEW STANDARD 318-08.

DIM	MILLIMETERS			INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.89	1.00	1.11	0.035	0.040	0.044
A1	0.01	0.06	0.10	0.001	0.002	0.004
b	0.37	0.44	0.50	0.015	0.018	0.020
c	0.09	0.13	0.18	0.003	0.005	0.007
D	2.80	2.90	3.04	0.110	0.114	0.120
E	1.20	1.30	1.40	0.047	0.051	0.055
e	1.78	1.90	2.04	0.070	0.075	0.081
L	0.10	0.20	0.30	0.004	0.008	0.012
L1	0.35	0.54	0.69	0.014	0.021	0.029
HE	2.10	2.40	2.64	0.083	0.094	0.104

STYLE 6:

1. BASE
2. EMITTER
3. COLLECTOR

### SOLDERING FOOTPRINT\*



\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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